

## Power Up – Tips from *Energizer* to Help Weather the Weather

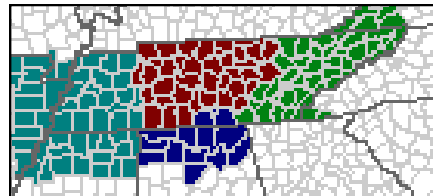
To make sure you have the power you need during and after severe weather, be sure to include a **Keep Safe. Keep Going®** power kit with your other emergency kit materials.

- Battery-powered radio or crank radio to keep your family apprised of current weather-related news.
- Plenty of extra batteries. (AA, AAA, C, D) provide long-lasting power before, during and after the storm. Lithium batteries have a long storage life, perform well in extreme temperatures and are perfect for use in LED flashlights and other high-tech devices.
- Flashlight for every member of the family. Use flashlights instead of candles when the power goes out.
- Battery-powered cell phone charger.
- Extra specialty batteries to power critical health devices like hearing aids and blood glucose monitors.

## For Your Information

This booklet contains materials useful during the Severe Weather Awareness Week campaign and at other times, too. You are invited to contact the National Weather Service, state and county emergency management agencies for interviews and for answers to your questions. National Weather Service personnel and local emergency management are available for weather awareness programs to civic and industrial organizations, schools, hospitals, and others interested in weather safety.

Each county in Tennessee is served by a designated National Weather Service Office as identified here:



Legend: **Nashville** | **Memphis** | **Morristown** | **Huntsville, AL**

**Please contact one of the National Weather Service Offices listed below if you need more information.**

Nashville.....	Tom Johnstone.....	(615) 754-4634
Nashville.....	Larry Vannozzi.....	(615) 754-4634
Morristown.....	Tim Troutman.....	(423) 586-8706
Morristown.....	George Matthews.....	(423) 586-6429
Memphis.....	Richard Okulski.....	(901) 544-0411
Memphis.....	Jim Belles.....	(901) 544-0411
Huntsville, AL.....	David Nadler.....	(256) 890-8503
Huntsville, AL.....	Michael Coyne.....	(256) 890-8503

## Information Resources on the World Wide Web

For additional resources, the following web sites are available:

NWS Nashville: [www.srh.noaa.gov/ohx](http://www.srh.noaa.gov/ohx)  
NWS Memphis: [www.srh.noaa.gov/meg](http://www.srh.noaa.gov/meg)  
NWS Morristown: [www.srh.noaa.gov/mrx](http://www.srh.noaa.gov/mrx)  
NWS Huntsville: [www.srh.noaa.gov/hun](http://www.srh.noaa.gov/hun)

All NWS Offices:  
<http://weather.gov>

TENNESSEE | SEVERE WEATHER AWARENESS WEEK | FEBRUARY 21-26, 2010

# TENNESSEE SEVERE WEATHER AWARENESS WEEK FEBRUARY 21-26, 2010



## Preparedness - Warning - Response



## Lives Saved

Proudly Sponsored By



## Tennessee Severe Weather Awareness Week Events February 21 - February 26, 2010

Throughout the week, the National Weather Service, Tennessee Emergency Management Agency and other supporting groups will conduct educational activities and drills to help people prevent injuries and deaths from tornadoes, damaging winds, flash floods, lightning, and hail. Each day of the week focuses on a specific type of severe weather or on the warning and drill system.

- **Sunday, February 21**, we'll begin the week by highlighting the important role of SKYWARN spotters.
- **Monday, February 22**, draws attention to hazards of Flooding and Flash Floods. Flooding is the #1 cause of weather-related fatalities. Remember...Turn Around Don't Drown!
- **Tuesday, February 23**, will focus on lightning, often called the underrated killer. All thunderstorms have lightning and this hazard can be deceptively deadly.
- **Wednesday, February 24**, will emphasize Tornado Safety. Over and over again, people survive tornadic weather by knowing weather safety rules and taking appropriate and timely actions. A state-wide tornado drill will be conducted on this day. Schools and state, county, and other interested agencies are encouraged to participate and help everyone learn life saving rules. Thursday will be the alternate drill day if adverse weather is expected on Wednesday.
- **Thursday, February 25**, we'll discuss Severe Thunderstorms. Damaging winds from severe thunderstorms are much more frequent than tornadoes in the Mid-South. These straight line winds can reach well over 100 miles an hour and can be devastating.

### About Our Sponsors



[www.energizer.com/preparedness/WeatherSafety/Default.aspx](http://www.energizer.com/preparedness/WeatherSafety/Default.aspx)



[/www.midlandradio.com/](http://www.midlandradio.com/)



*For 70 years, NES has been powering the city of Nashville. We are committed to this community, and we work hard every single day to make this city shine.*

[www.nespower.com](http://www.nespower.com)

### About The Cover Page

A woman and 8 kids took shelter in the kitchen closet of her Murfreesboro home during the April 10th tornado. The closet was the only part of the house left standing after the tornado. The group had to break out the drywall to escape, but none were harmed.

*Photograph by Michael Davis*

## DRILL DAY Wednesday, February 24, 2010 9:00 - 9:30 Local Time

**A TORNADO DRILL** will be conducted Wednesday morning, February 24, 2010, between 9:00 AM and 9:30 AM **Local Time**, weather permitting, as part of SEVERE WEATHER AWARENESS WEEK in Tennessee. *If Wednesday's weather is inclement, the test will be Thursday, February 25, 2010 (same times).*

Sometime during this hour, each National Weather Service office in the state will issue a test tornado drill message. The message will be sent under the Weekly Test Product (RWT) disseminated by NOAA Weather Radio and the EAS alert system.

**The Weekly Test Product**, with the tornado drill message, will be broadcast on all NOAA Weather Radio Transmitters across Tennessee and those transmitters in North Mississippi that cover Tennessee counties.

**A Drill** such as this gives schools, churches, business offices and plant safety managers across the state a chance to check the readiness of their Severe Weather Safety plans. If your office has a plan already in place, test it to make sure your employees know how to respond properly. If your employees know how the safety procedures work, they can carry them out effectively when the time comes.

**IF YOUR WORK PLACE, SCHOOL OR CHURCH DOES NOT HAVE A SAFETY PLAN, NOW IS THE TIME TO START ONE!!** Developing a safety plan is not difficult. If a plan is easy to operate, it is more likely to be successful when needed. Countless lives are saved each year by planning, preparedness and proper education. The U.S. population has grown in recent years, yet the number of tornado deaths has diminished. This is due to agencies and individuals developing Weather Safety Plans and to people reacting in a prudent manner when severe weather threatens their areas.

**YOUR SAFETY AND THAT OF YOUR FAMILY, FRIENDS AND  
CO-WORKERS DEPENDS ON YOU!!**

### Grant Opportunities for Emergency Managers

State Farm Insurance has a grant program entitled "Safe Neighbors Grant" which can be used to purchase Turn Around, Don't Drown (TADD) signs. Information about this grant can be found at [www.statefarm.com/about/part\\_spos/grants/cogrants.asp](http://www.statefarm.com/about/part_spos/grants/cogrants.asp). To request a grant application, contact the State Farm Murfreesboro Operations Center at 615-692-6000.

The Walmart Corporation also has a grant program for each Walmart and Sams's Club store. To learn more about the program applicants are urged to view the company's Giving Program Guidelines at [www.walmartstores.com/CommunityGiving/8916.aspx](http://www.walmartstores.com/CommunityGiving/8916.aspx) or contact the Facility Manager or Community Involvement Coordinator at the nearest



NWS StormReady Program of Tennessee



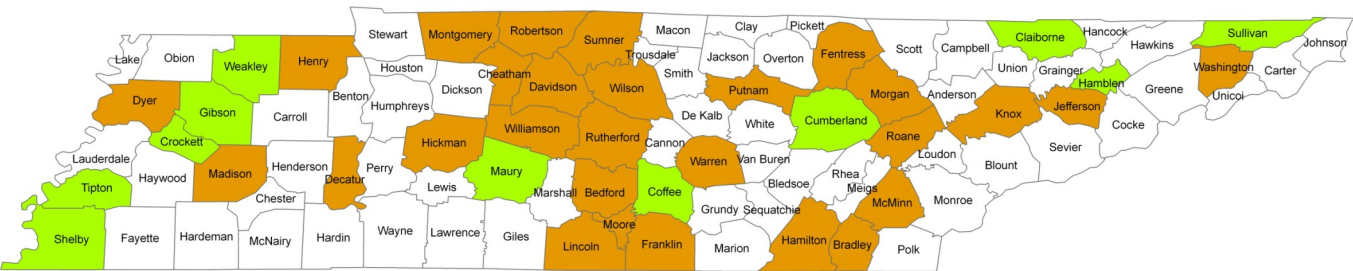
The National Weather Service (NWS), in partnership with local emergency management, law enforcement, and local government agencies, works to protect the public they serve from the hazards of severe weather through the StormReady program. The StormReady program serves to protect the public through advanced severe weather planning, public education, and awareness. When the public is better informed of the threats from severe weather – lives are saved. It is the goal of all StormReady participants to maximize the protection of life and property by ensuring that the local public is properly prepared and promptly warned when severe weather is expected or occurring.

The StormReady program has established requirements that participating agencies must perform that help mitigate threats from hazardous weather. These tasks include: (1) establishing a 24 hour Warning Point and Emergency Operations Center; (2) having multiple ways of receiving severe weather warnings and forecasts to alert the public; (3) creating a system that monitors weather conditions locally; (4) promoting public readiness through community seminars; and (5) developing a normal hazardous weather plan, including severe weather spotter training and emergency training exercises. These StormReady recommendations were found to increase severe weather awareness and preparedness across areas where they have been implemented. Considering that greater than 90% of declared disasters are weather related, it remains imperative that severe weather education in local communities remain a top priority. This will ensure that the public is prepared to protect themselves from the dangers of severe weather. The StormReady program serves as an avenue to accomplish this mission.

Several counties, local communities, and major businesses across Tennessee have become StormReady or StormReady Supporters since the program's implementation. In all – thirty nine counties across the state of Tennessee are StormReady, including the four most populous counties of Shelby, Davidson, Knox, and Hamilton. This includes the major state metropolitan areas of Memphis, Nashville, Knoxville, and Chattanooga. In addition to the county and city level support of StormReady; several large private vendors/universities including the FedEx Forum in Memphis, Fayetteville Public Utilities, and Vanderbilt University support severe weather education as well as public safety and awareness through the StormReady Supporter program. The collective actions of these public and private entities through the StormReady and StormReady Supporters program accomplish the number one goal of saving lives.

The National Weather Service tirelessly promotes this worthwhile program and recruits new participants through its local warning coordination/outreach program. The NWS encourages any agency interested in becoming a new StormReady participant to contact their local NWS office. For additional information, detailed requirements, and program benefits, please visit: <http://www.stormready.noaa.gov/supporter.htm>. Working together, we all can do our part to protect the citizens of Tennessee from the dangers of hazardous weather.

StormReady Counties in Tennessee



Tennessee StormReady

- Future StormReady Counties
- StormReady Counties
- StormReady Counties Added 2009



Tennessee SKYWARN®

Sunday, February 21 , 2010

By Tim Troutman - Warning Coordination Meteorologist - WFO Morristown

SKYWARN® is the program developed by the National Weather Service to recruit and train storm spotters. SKYWARN® spotters enhance the National Weather Service's storm detection capabilities by identifying and reporting potentially dangerous weather conditions. The SKYWARN® program has become an invaluable link in the NWS warning process.

Despite all of the sophisticated technology used in a modern NWS office, forecasters still rely on storm spotters. Doppler radar may indicate that a storm may be producing large hail, damaging winds or even a tornado, but it cannot tell exactly what's happening on the ground underneath the storm. Storm spotters, trained by NWS meteorologists, act as the eyes and ears of the NWS. Their reports, radar data and other information result in the most timely and accurate warnings possible.

SKYWARN® spotters in Tennessee come from all walks of life – law enforcement, fire or emergency management agencies and citizens interested in helping their communities. A large number of storm spotters are amateur radio operators, who volunteer their time and equipment to help the NWS detect and track severe storms.

Amateur radio operators, or "hams", will frequently operate radio equipment at the local NWS office, gathering reports from spotters in the field and relaying the data directly to NWS forecasters. SKYWARN® spotters are volunteers – they receive no compensation for their hard work. They do, however, have the satisfaction of knowing that their reports result in better warnings which save lives. If you are not an amateur radio operator and still want to report information directly to the NWS, you can participate in the e-spotter program. The e-spotter program is a web based program that will allow a spotter the ability to transmit a storm spotter report via the web directly to a local NWS office in real time. The link to the e-spotter program is at: <http://espotter.weather.gov/>

Who is Eligible?

The NWS encourages anyone with an interest in public service and access to communication, such HAM radio, to join the SKYWARN® program. Volunteers include police and fire personnel, dispatchers, EMS workers, public utility workers and other concerned private citizens. Individuals affiliated with hospitals, schools, churches, nursing homes or who have a responsibility for protecting others are also encouraged to become a spotter.

How Can I Get Involved?

You can participate in the SKYWARN® program in your area by attending a storm spotter training class to become a trained spotter. Each of the training sessions is free, lasts around two hours and covers the following concepts:

- Basics of thunderstorm development
- Information to report
- Fundamentals of storm structure
- How to report information
- Identifying potential severe weather features
- Basic severe weather safety

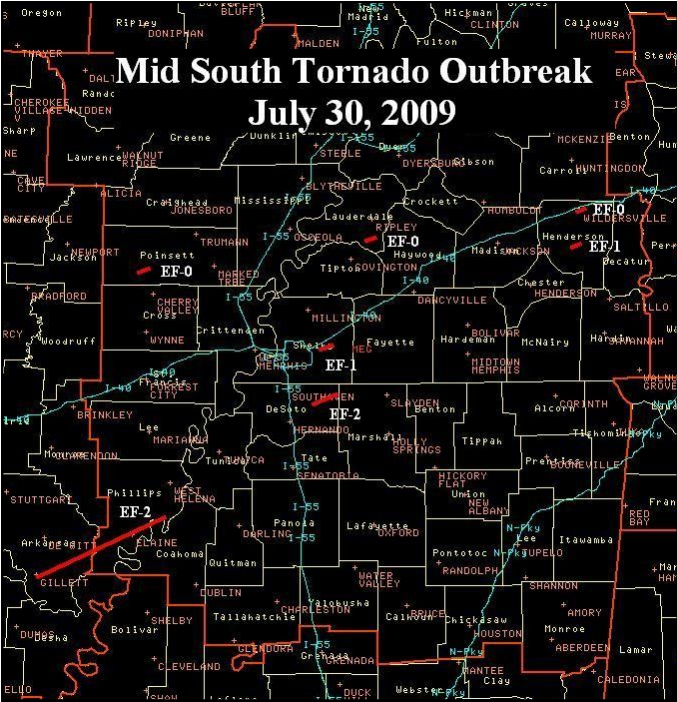
Please contact one of the National Weather Service Offices listed below if you need more information about an upcoming SKYWARN® class.

Memphis.....	Richard Okulski.....	(901) 544-0411
Nashville.....	Tom Johnstone.....	(615) 754-4634
Huntsville, AL.....	David Nadler.....	(256) 890-8503
Morristown.....	Tim Troutman.....	(423) 586-8706

Here are links to each Tennessee National Weather Service office storm spotter training pages. They are:  
WFO Memphis: [http://www.srh.noaa.gov/meq/?n=skywarn\\_meetings](http://www.srh.noaa.gov/meq/?n=skywarn_meetings)  
WFO Nashville: <http://www.srh.noaa.gov/ohx/?n=spotterclasses>  
WFO Huntsville: <http://www.srh.noaa.gov/hun/?n=skywarn>  
WFO Morristown: <http://www.srh.noaa.gov/mrx/?n=spotterclasses>



July 30<sup>th</sup>, 2009 Midsouth Tornado Outbreak  
By Chris Duke  
NWS Memphis

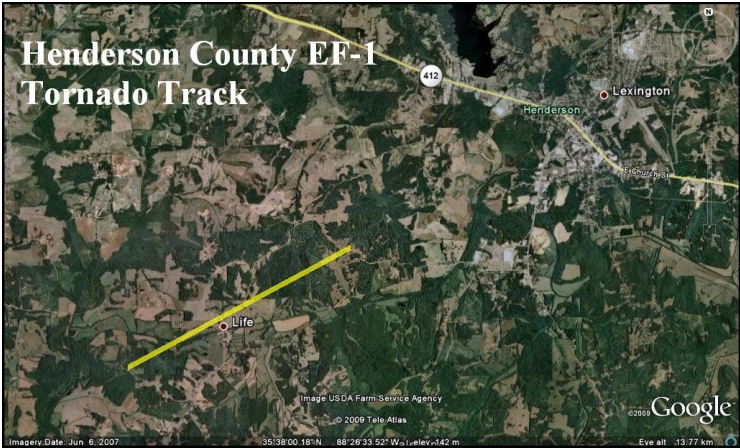


On the afternoon of July 30, 2009, the midsouth experienced its second tornado outbreak of the summer. A total of 7 tornadoes swept through northeast Arkansas, west Tennessee, and northern Mississippi causing over \$11 million in damage. Thankfully, no fatalities or injuries were reported. The tornadoes formed along the moist and unstable southeast periphery of a strong surface low pressure system, supported by an upper level disturbance moving out of the southern plains. 4 of the 7 tornadoes struck the state of Tennessee.

The Memphis metro area was also affected by this outbreak. An EF-1 tornado with maximum sustained winds between 90 and 100 mph struck Shelby county causing \$250,000 in damage. The path length of this tornado was 2 miles with a damage width of 750 feet. At 3:49 pm, the tornado touched down just east of the intersection of Interstate 40 and Appling Road. The tornado damaged a couple of baseball fields and proceeded northeast. A Kohl's department store and a Toyota dealership sustained damage. Several vehicles had windows blown out. A tractor-trailer was also overturned in the Kohl's parking lot. The tornado then crossed Germantown Parkway and damaged a Shogun Japanese Restaurant, a gas station and several other

businesses. The tornado then proceeded northeast into a residential neighborhood where 97 homes sustained minor damage. Four apartment complexes and a total of 25 businesses received at least minor damage. Trees were also uprooted and snapped in the area. The tornado then moved into a golf course where at least 50 trees, fences and one small building was damaged. The tornado lifted near the center of the golf course. An off-duty firefighter was killed a few days later cleaning up storm debris when a tree fell on him.

Later in the evening, another tornado struck west central portions of Henderson county Tennessee. This tornado touched down near Mills Darden Road at 6:40 pm and moved northeast lifting near Old Jackson Road. A few outbuildings were damaged or destroyed along the path. Multiple trees and power lines were knocked down as well. A mobile home was moved from the foundation into a power pole. A total of \$50,000 in damage was sustained. The path length was 3.7 miles with a damage width of 300 feet. This tornado was rated as an EF-1 with maximum wind gusts to 90 mph. Just to the north, another tornado briefly touched down near Webb Road in Wildersville. Shingles were blown off a church roof. Significant structural damage occurred to a shed on the church property. Several tree limbs in the area were knocked down and one power pole was broken. This tornado caused \$25,000 in damage and was very short in duration with a track length of only 0.1 miles and a damage width of 90 feet.



Another very brief tornado touched down just southeast of Henning in Lauderdale county Tennessee just northwest of the intersection of Queens Crossing Road and John Moorer Road. The total track length was only 0.1 miles and a damage width of 150 feet. The tornado lifted shortly after crossing Queens Crossing Road. A corn field was damaged. Several trees were damaged in the area as well. Maximum wind gusts were 75 mph giving this tornado an EF-0 rating.

NOAA Weather Radio and Emergency Alert System Day  
Friday, February 26, 2010  
By David Nadler - Warning Coordination Meteorologist, WFO Huntsville

The National Weather Service (NWS) utilizes NOAA Weather Radio All-Hazards to broadcast continuous weather information 24 hours a day, every day of the year. To receive the broadcasts originating from the NWS, you need a special radio capable of receiving signals in the Very High Frequency (VHF) public service band. The state of Tennessee is served by 21 NOAA Weather Radio (NWR) transmitters with several surrounding transmitters outside the state covering Tennessee counties. Approximately 95 percent of the people in Tennessee are within range of a NWR transmitter (see list of NWR transmitter locations and frequencies in table below).

While routine programming offers the latest forecasts, hazardous weather outlooks, current weather conditions, and official climate data, the broadcast cycle is automatically updated and at times interrupted whenever a specific weather watch, warning, or advisory is issued by an NWS Forecast Office. Watches, warnings, advisories and special weather statements are given the highest priority on NWR and are frequently updated with critical weather information.

In an emergency, each station will transmit a warning alarm tone in addition to the SAME (Specific Area Message Encoding) tone. Information on the emergency situation then follows. These alert tones, especially the SAME, are capable of activating specially-designed receivers by producing a visual and/or audible alarm. Not all weather band receivers have this capability but all radios that receive the NWR transmission can receive the emergency broadcasts. The warning alarms and SAME tones are tested each Wednesday, typically between 11AM and Noon, weather permitting.

Commercial radio and television stations as well as cable television companies are encouraged to use NOAA Weather Radio in order to rebroadcast pertinent weather information to the general public. NWR is also a major part of the Emergency Alert System (EAS), hence the "All-Hazards" tag, with improved technology to more efficiently process critical weather warning information through commercial broadcast outlets.

Location	Frequency
Memphis	162.475
Dyersburg	162.500
Jackson	162.550
Vale	162.450
Lobelville	162.400
Clifton	162.500
Lawrenceburg	162.425
Waverly	162.400
Clarksville	162.500
Centerville	162.525
Nashville	162.550
Beechgrove	162.475
LaFayette	162.525
Hickman	162.500
Cookeville	162.400
Winchester	162.525
Spencer	162.500
Chattanooga	162.550
Knoxville	162.475
Tri-Cities	162.550
LaFollette	162.450





**Mountain Waves – Another Cause of Strong and Damaging Winds**  
**By David Gaffin- Senior Forecaster – WFO Morristown**

Mountain waves are typically observed near large mountain ranges around the world when the large-scale winds are perpendicular to the mountain ranges. These mountain waves can produce very strong wind gusts in a narrow area along the foothills, and can also create strong turbulence that adversely affects aviation. The formation of mountain waves is similar to when fast-moving water flows over a large boulder in a river (Figure 1). As the river current flows over the stationary boulder, waves are formed downstream of the boulder. The atmosphere behaves in a similar fashion when the wind flow encounters a large mountain range (a stationary object) with a stable air mass in place. In a stable air mass, air wants to either remain at its same altitude or descend (much like water always wanting to flow downhill). So, when a strong southeast wind flow is perpendicular to the southwest-to-northeast oriented southern Appalachians, it will be forced to rise over the mountains. With a stable air mass also in place, the wind will behave like water and immediately descend on the other side of the mountains in the form of a wave. Mountain waves generally occur during the cooler months of the year from late fall through early spring (mid October to mid April), when large low pressure systems and stable air masses are more common. The peak month for mountain wave activity in the western foothills of the southern Appalachians is December. These events generally do not occur during the summer months.

Strong wind gusts from mountain waves generally only affect a narrow zone in the foothills where the bottom of the wave intersects the ground. During a mountain wave event, many people outside of the foothills will not experience much wind and may wonder "what is all the fuss about?". However, those people who live in the narrow corridor along the foothills where these waves intersect the ground can sometimes experience hurricane-force wind gusts. Wind gusts around 100 mph have been routinely measured at Cove Mountain in the Great Smoky Mountains National Park during strong mountain wave events when strong southeast winds occurred within a stable air mass. Wind gusts in excess of 80 mph have also been measured at Camp Creek in southeast Greene County during mountain wave events. While high winds due to mountain waves occur all along the foothills of the southern Appalachians (including the Cumberland Plateau), the Cove Mountain and Camp Creek observation sites are places that routinely experience strong winds due to their favorable terrain location. A favorable terrain profile for mountain waves is one where steep slopes are found on the leeward side (side facing opposite the direction the wind comes from) with more gently-rising slopes on the windward side (side facing the direction the wind comes from). Mountain waves also can occur along the eastern foothills of the southern Appalachians when the wind flow is from the northwest. While mountain wave events occur more frequently on the eastern side of the mountains (due to the more frequent occurrence of northwest winds versus southeast winds), it is likely that high winds due to mountain waves are stronger on the western side because of the steeper slopes that quickly descend into the Great Tennessee Valley (Figure 2). However, due to the lack of observations near the mountains, this theoretical claim can not be fully verified.



Figure 1. Stationary waves being formed by a large boulder in a fast-moving river (above).

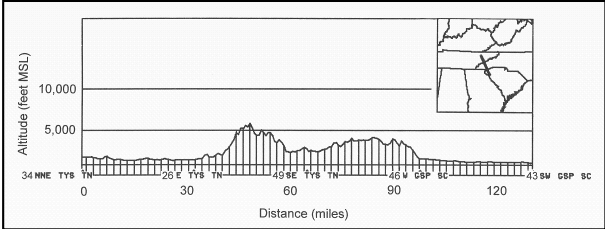


Figure 2. Vertical cross-section profile (inset at the top right indicates the cross-section axis) of the Smoky Mountains from the northwest (left) to the southeast (right).

**Flooding and Flash Flooding are the #1 weather related killer!**  
**Monday, February 22, 2010**  
**By James LaRosa - Service Hyrdrologist, WFO Nashville**

**FLASH FLOODING:** Flash floods can occur within a few minutes or up to 6 hours after excessive rainfall, a dam or levee failure, or a sudden release of water held by an ice jam or mud slide. Flash floods can tear out trees and destroy buildings and bridges. Because flash floods happen in a short period of time (less than six hours after the causative event) they are more life threatening than other types of flooding. Areas most susceptible to flash flooding are mountainous streams and rivers, urban areas, low-lying areas, storm drains, and culverts. The mountain regions of middle and east Tennessee potentially have more flash flood problems than west Tennessee but all parts of the state are susceptible.



A Flash Flood Warning is issued when flash flooding has been reported or is imminent. It focuses on specific communities, creeks or streams, or other geographic areas where flooding is imminent or occurring.

**RIVER FLOODING:** This type of flooding is caused by an increased water level in established watercourses, such as a rivers, creeks, or streams. River flooding is slower to develop than flash flooding (more than 6 hours after the causative event), however, some smaller creeks and streams have a short lag time between the runoff from heavy rain and the onset of flooding. This is the case with some middle and east Tennessee rivers and streams. On the other hand, it may take several days for a flood crest to pass downstream points on major rivers such as the Cumberland, Tennessee, and Mississippi rivers. The National Weather Service issues River Flood Warnings when rivers are expected to rise above flood stage. Persons in the warned area are advised to take necessary precautions immediately. River stages and crest forecasts are given for selected forecast points along with known flood stages for each forecast point. While there is usually more advanced warning time with river floods than with flash floods, persons should be familiar with the flood prone areas they live and work in, and must know what action to take and where to go if a flood occurs. Advance planning and preparation is essential.



**FLOOD WATCHES:** The National Weather Service issues a Flood Watch when conditions are detected that can result in either flooding or flash flooding within a designated area, but the occurrence is neither certain nor imminent. If the flooding is expected to quickly develop, a Flood Watch for flash flooding is issued. If the flooding is expected to develop slowly or occur on area rivers, a Flood Watch for a county or counties is issued, or for a particular location along a river. Persons in the watch area are advised to check flood action plans, keep informed, and be ready to take action if a warning is issued or flooding is observed.

**FLOOD ADVISORIES:** Flood Advisories are issued when flooding is expected to develop, but not be a significant hazard. This may be when poor draining areas collect water, low lying areas along river banks become inundated, or when caution is needed due to intense rainfall from a passing storm. Even though the flooding expected with a flood advisory may not to be life threatening, persons should still be alert for rapidly changing conditions.

**FLOOD SAFETY RULES:** Follow these tips to stay safe during flood conditions... When a warning is issued get out of areas subject to flooding. These may include dips, low spots, stream beds, drainage ditches and culverts. If caught in low areas during flooding, go to high ground immediately.



Avoid already flooded and high velocity flow areas. A rapidly flowing stream or ditch can sweep you off your feet or even carry your car or truck downstream. Never drive through a flooded area as the road bed may be washed away. Play it safe! If you encounter a flooded road - TURN AROUND, DON'T DROWN!

Be especially cautious at night when it is harder to recognize flood conditions, and never drive around a barricaded road. The State of Tennessee passed a law (TCA 55-10-205) making it illegal for motorists to drive around barricades or visible flood warning signs. Anyone that does and needs to be rescued may be subject to a reckless driving citation, numerous fines, and ordered to repay any costs associated with the rescue.

Most flood deaths occur at night and when people become trapped in automobiles that stall in areas that are flooded. If your vehicle stalls, abandon it immediately and seek higher ground. The rising water may engulf the vehicle and the occupants inside. Do not camp or park your vehicle along streams or washes during threatening conditions.

**When a FLOOD WARNING is issued for your area, act quickly to save yourself. You may only have seconds!**



## Lightning The Underrated Killer Tuesday, February 23, 2010



### EVERY THUNDERSTORM CONTAINS LIGHTNING.

Nationwide in 2009 34 people were killed by lightning. Fortunately, none of those killed were in the Volunteer State. Since 1959 a staggering 3919 people have lost their lives as a direct result of being struck, with 140 of those deaths in Tennessee. The 140 deaths places Tennessee in the top 5 of states in terms of lightning fatalities. In an average year around 25 million lightning strikes are recorded across the United State alone. Worldwide there are around 1800 thunderstorms ongoing at any given time. Lightning is an incredibly powerful electrical discharge, containing up to 100 million volts of electrical charge and capable of reaching 50000 degrees Fahrenheit. Cloud to Ground Lightning is the result of incredible differences in electrical charge which forms within thunderstorms...as well as between thunderstorms and the earth's surface. Recent

science suggests that ice in thunderstorms is key to creating the massive charge differences which lead to lightning.. Thunderstorm updrafts and downdrafts work to separate smaller ice particles from larger hail stones within the storm. As this happens many of the ice pieces collide resulting in a separation of electrical charge. The higher part of the storm contains primarily positively charged small ice crystals, with negative charged larger chunks of ice down low. As the storm moves across the earth a pool of positively charged particles gathers near the ground. Eventually a brief electrical circuit is created as a negatively charged "step leader" descends from the storm toward the ground and eventually connects to the positive charge on the ground. The extreme heating of the air with lightning causes a rapid expansion of the air around it...leading to thunder. The sound of Thunder will travel away from lightning at a speed around 1 mile every 5 seconds. If you can see lightning and hear thunder at your location you are not safe...If you hear thunder within 30 seconds after seeing lightning your life is in immediate danger.

### Lightning Safety Rules—Outdoors

- **Seek shelter** inside a house, large building or an all metal vehicle with the windows rolled up (avoid convertibles).
- **If your hair stands on end and your skin tingles... lightning is about to strike. Take cover immediately!**
- When boating, head for shore and get into a shelter, or vehicle. If caught in a boat, lie down in the boat with cushions between you and the boat's side and bottom.

### AVOID

- Large trees, hilltops and other high places.
- Chain link fences and any other metal fences like those around ball parks and play grounds.
- Motorcycles, scooters, golf carts, small metal sheds, bicycles, tractors and farm equipment that does not have an enclosed metal cab.



In Fentress County an oil tank exploded and flew over 100 yards after being struck by lightning. *Photograph by Jeff Galloway*

### Lightning Safety Rules - Indoors

- **Stay away from windows.** Avoid telephones and electrical appliances (wires connecting to these devices run outside of the home and act as lightning rods). Don't wash dishes or take a shower. The pipes will conduct electricity.
- **Unplug computers** and other sensitive electrical devices (time permitting) since surge suppressors may not protect these items if lightning hits close to the home.
- **Remember, there is no truth to the old myth that "lightning never strikes twice."**
- Take time this week to learn or refresh your memory on lightning safety rules. That quick dash out in the open when a thunderstorm is in progress may unnecessarily expose you to the possibility of being struck. It is not worth the risk.
- **If a person is struck by lightning, there is no residual charge left on the body. The quick application of CPR may maintain vital body functions until medical help can be obtained.**

## Hail By Rachel Haynes, WFO Nashville

### How Is Hail Formed?

Hail is formed when water droplets are drawn into an area of strong upward moving air, known as an up-draft, of a storm. Once the water droplets are transported above the freezing level, they combine with tiny airborne particles, such as dirt, volcanic ash, etc., and freeze on contact, forming tiny ice particles. These ice particles are light enough that they remain suspended in the cloud, where they undergo processes that allow them to combine with other supercooled water droplets and grow into hail stones. Once the hail stones are heavy enough to overcome the upward force of the updraft, they fall out of the cloud. By definition, hail stones are 5 millimeters or larger, and can inflict significant damage to automobiles, buildings, crops, and even people.



Macon County - April 2006 Photo By WSMV

### New NWS Hail Criteria!

As of January 5, 2010, the National Weather Service has changed the severe hail criteria from 3/4 inch to 1 inch. Why the change? There are a couple of reasons. Research has shown that significant damage caused by hail does not occur until the hail diameter reaches one inch (approximately quarter size) or larger. Requests from NWS partners such as emergency managers and the media further prompted the decision to increase the severe hail criteria due to the fact that more frequent severe thunderstorm warnings may act to desensitize the public from their meaningfulness. Such an effect could cause people not to take caution during such a warning, which could lead to unnecessary damage or injury. The change means that severe thunderstorm warnings will be issued less frequently so that a greater emphasis can be placed on more substantial hail threats.

The NWS in Tennessee will issue a **Significant Weather Advisory** under the Special Weather Statement (SPS) header when thunderstorms are expected to produce smaller than quarter sized hail for your county.



For more info visit: <http://www.weather.gov/oneinchhail/>

### Hail Size Estimates

Pea.....	1/4 inch
Penny.....	3/4 inch
Quarter.....	1 inch
Half Dollar.....	1 1/4 inches
Golf Ball.....	1 3/4 inches
Tennis Ball.....	2 1/2 inches
Baseball.....	2 3/4 inches
Grapefruit.....	4 inches



# Severe Thunderstorms

## Thursday, February 25, 2010

### By Rachel Haynes, WFO Nashville



### What is a Severe Thunderstorm?

A severe thunderstorm is a thunderstorm that produces one or more of the following: hail that has a diameter of one inch or larger, winds greater than or equal to 58 mph, and tornadoes. About 10% of all thunderstorms in the U.S. meet severe criteria.

Severe thunderstorms can occur at any time of year, although the most common time of occurrence is during the spring months of March, April, and May.

There is also a lesser known secondary season during the fall, in November and early December.

### What is the Difference between a Watch and a Warning?

A severe thunderstorm watch means that conditions are favorable for severe thunderstorms to develop. These are issued by the Storm Prediction Center in Norman, OK, typically before severe weather is developing.

A severe thunderstorm warning means that a severe thunderstorm has either been indicated on radar or witnessed by storm spotters firsthand. Your local NWS Forecast Office issues these when severe weather is developing or occurring.



Fentress County - February 12, 2009  
Photo By Jeff Galloway

### Safety Tips

- **Have a plan.** Prepare ahead of time so you and your family know what actions to take when severe weather occurs.
- **Get indoors!** There is no safe place outdoors during a thunderstorm.
- **Stay informed!** When severe weather threatens, stay tuned to NOAA Weather Radio, local television and radio stations, or the National Weather Service webpage at [www.weather.gov](http://www.weather.gov) for up to date information on the weather situation.
- **Know what county you are in.** When a warning is issued, the threatened area will be identified by the counties that contain it.
- **Have a NOAA Weather Radio.** This is the best way to receive the latest and most up to date weather information from the National Weather Service.



# Good Friday: Murfreesboro, Tennessee

## Tornado Outbreak

Authored by Danny Gant



On 10 April 2009, several meteorological factors came together to produce a day filled with tornadoes, and severe thunderstorms across the southeastern United States. There were a total of 69 tornado reports, and 283 hail reports. These reports were highlighted by a strong EF-4 tornado in Rutherford county. The Rutherford county tornado had a devastating impact on the city of Murfreesboro. It was packed with 170 mph winds, and was the 28<sup>th</sup> tornado to hit the county since 1950. It was the first killer tornado for Rutherford county. On this day a **Tornado Emergency** was added to the warning for Rutherford county. This meant that a deadly tornado had been spotted by various eyewitness accounts, and was headed for populated Murfreesboro. The path of the tornado began at 12:19 P.M. at the intersection of Kelley Rd. and Hwy 41A. It continued in a general northeast direction for 23.2 miles until lifting from the ground 8 miles northeast of Murfreesboro. A total of 845 structures were damaged as a result of this storm and out of those, 117 were completely destroyed. Damage estimates were approximately 41.8 million dollars. The figure above shows the tornado looking out to the northwest from Murfreesboro. Looking to the right of the main vortex, a secondary vortex can be seen. This is known as a multiple vortex tornado. Many tornadoes exhibit these characteristics at some point in their life cycle. This image however, is a great representation of this activity. The various figures below are from the ground and aerial damage surveys done by the National Weather Service and the Tennessee Emergency Management Agency (TEMA). These damage surveys took place on the two days following the Good Friday storm system. One image in particular is of a group of friends who rode out the storm in a closet of one's home.



Fig 1. Image of multi-vortex tornado moving through Murfreesboro on April 10, 2009. Photographed by Jeff Smith



Fig 2. Various images of aerial and ground tornado damage. Also an image of a group of tornado survivors.



**Tornadoes**  
**Wednesday, February 24, 2010**  
**By Rachel Haynes, WFO Nashville**



Tornado - Robertson Co. - January 2010

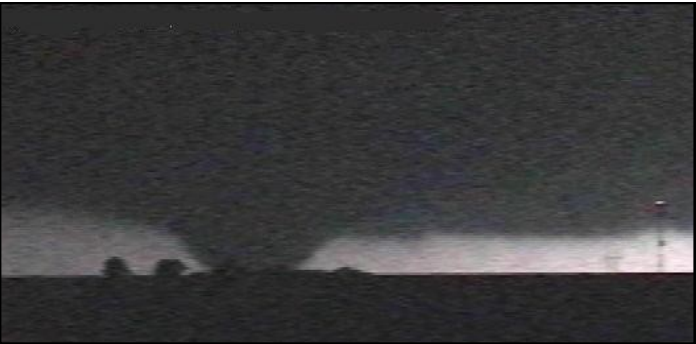
**What is a Tornado?**

A tornado is a violently rotating column of air that extends from the base of a storm cloud to the ground. Some conditions that are conducive for tornado formation include warm, moist, unstable air, strong atmospheric winds that increase in speed and change direction with height, and a forcing mechanism to lift the air. When a combination of these factors comes together just right, tornadoes form. The most common time of year for tornado formation in Tennessee is during the spring months of March, April, and May, with a secondary tornado season in November and December. Additionally, the afternoon and

evening hours are the times of day at which most tornadoes occur, as they are the times at which the maximum heating takes place. However, tornadoes can occur at any time of day, and at any point during the year, given the right environment.

**Nighttime Tornadoes Pose Greater Danger**

This winter season, NOAA's Storm Prediction Center (SPC) is drawing more attention to the dangers of nighttime tornadoes. Tornadoes that occur during the overnight hours pose a greater danger than those that occur during the daylight because once most people go to bed, they are no longer connected to the watches or warnings issued by the NWS. This is elevated during the winter months because it is not the traditional tornado season. Because of these problems, SPC has created a way by which the public can be notified of the possibility of strong to violent tornadoes before they go to bed. In cases when conditions look favorable for overnight tornado development, SPC will issue a public severe weather outlook, available on their website at <http://www.spc.noaa.gov>.

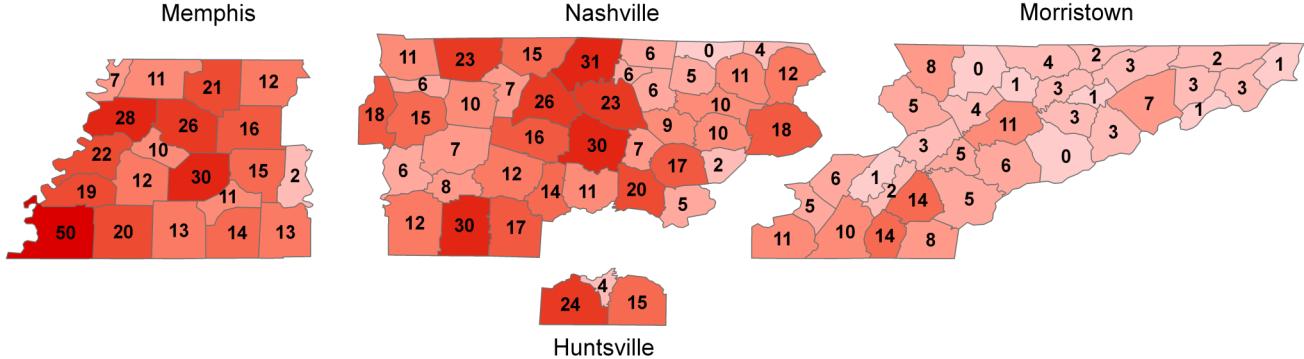


Large tornado backlit by lightning.  
*Photograph by Roger Edwards /Rich Thompson*

**Enhanced Fujita Scale (EF Scale)**

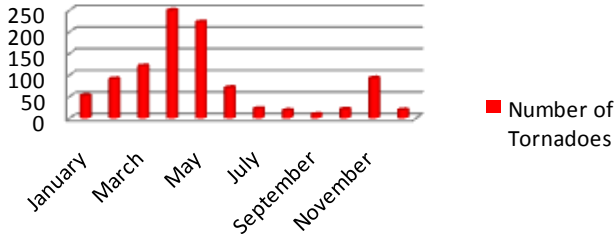
EF Rating	Wind Speeds	Potential Damage Threats
EF 0 (weak)	65-85 mph	Light damage, shallow rooted trees pushed over, some damage to gutters or siding.
EF 1 (weak)	86-110 mph	Moderate damage, mobile homes overturned, roof surfaces peeled off.
EF 2 (strong)	111-135 mph	Considerable damage, large trees uprooted or snapped, mobile homes destroyed.
EF 3 (strong)	136-165 mph	Severe damage, trains overturned, well built homes lose roofs and walls.
EF 4 (violent)	166-200 mph	Devastating damage, well built homes leveled, cars thrown.
EF 5 (extreme)	Over 200 mph	Incredible damage, well built homes disintegrated, automobile-sized objects thrown >300ft.

**Tornado count in Tennessee by county 1950 - 2009**

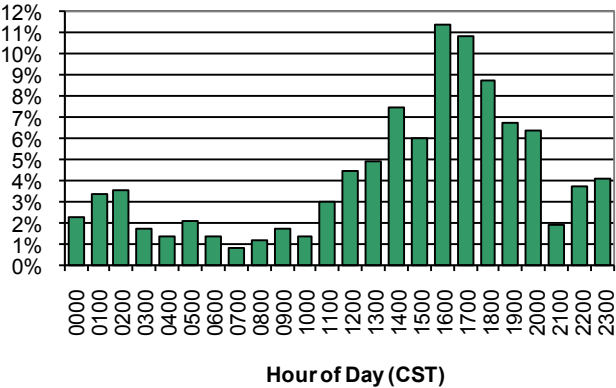


In '09, 39 TN counties were affected by tornadoes. There were 2 fatalities statewide and 62 injuries. Tornado damage estimates for the year exceeded \$100 million.

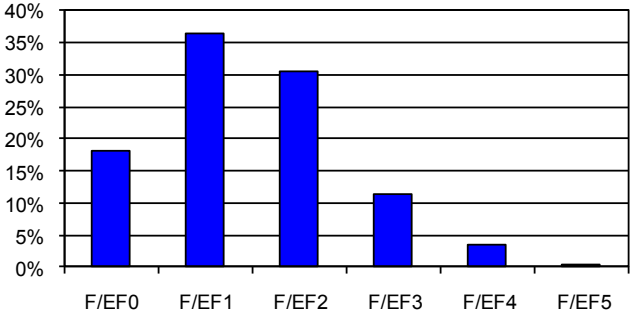
**Tennessee Tornadoes by Month 1950 - 2009**



**Tornado Occurrences by Hour of Day**



**Tornado Occurrences by F/EF-Scale**



**Tornado Occurrences by Month**

